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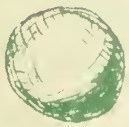
SILVICAL CHARACTERISTICS *of*

EASTERN REDCEDAR



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M. J. Williamson

Central States Forest Experiment Station Miscellaneous Release 15
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This the first of a series of 17 papers dealing with the silvical characteristics of forest trees important in the Central States region. The following species are included in this series:

Ohio buckeye
Yellow buckeye
Northern red oak
Black oak
Chinkapin oak
Pin oak
White oak
Swamp white oak
Bur oak
Butternut
Black walnut
Shellbark hickory
Sycamore
Honeylocust
Hackberry
Black locust
Eastern redcedar

Papers covering additional important American species will be issued by other Forest Experiment Stations of the U. S. Forest Service, and a book describing the silvical characteristics of all important forest trees in the United States is scheduled for publication by the Forest Service in 1958.

Central States Forest Experiment Station, U. S. Dept. of Agriculture
Forest Service, 111 Old Federal Building, Columbus 15, Ohio
W. G. McGinnies, Director

August 1957

Silvical Characteristics of Eastern Redcedar

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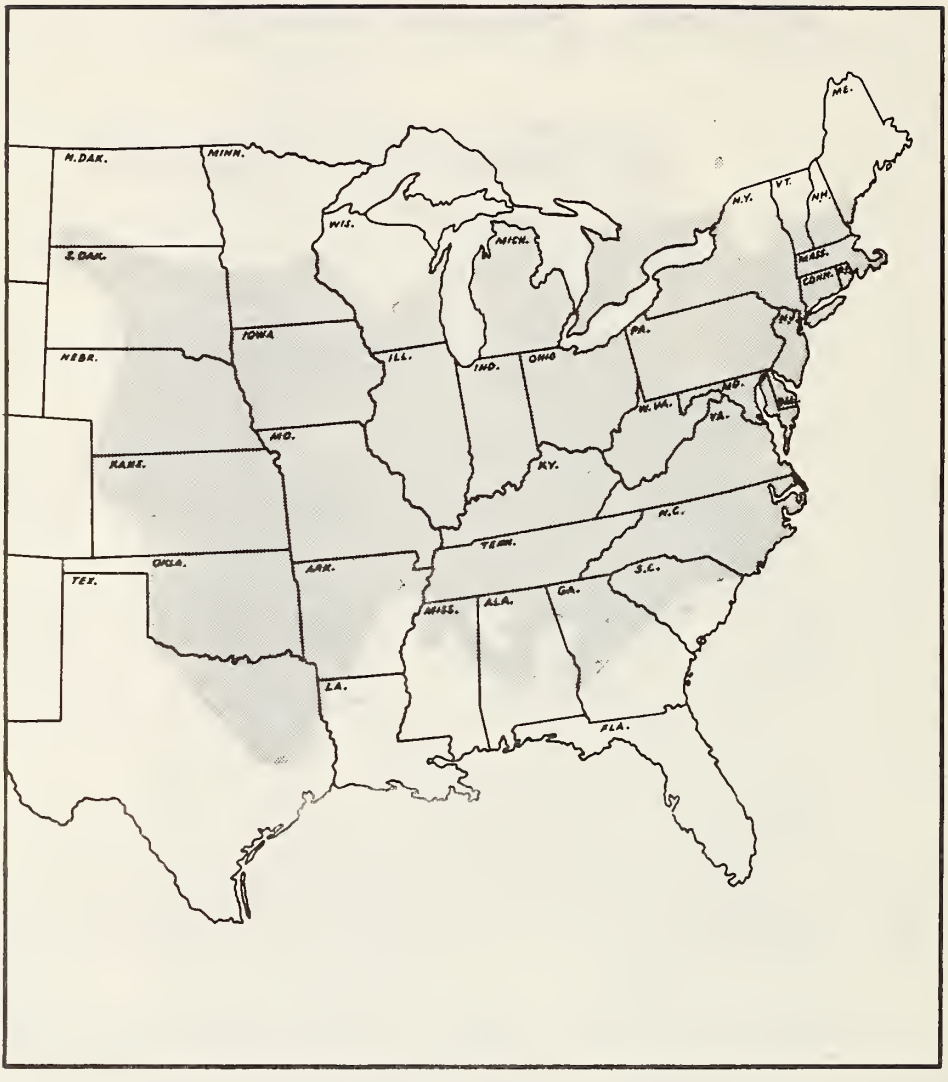
Eastern redcedar (Juniperus virginiana L.) is a familiar tree of the eastern United States. Scattered commonly along fence rows, in abandoned fields, and on dry hillsides, the dense, slender, green spires of eastern redcedar are found beautifying the countryside.

Although there are 13 species of Juniperus native to the United States, eastern redcedar is the only commercially important timber tree in the group (27). Since early colonial days eastern redcedar has been a favored wood because of its exceptional durability, cutting qualities, rich color, and aroma. Even the leaves and fruits are used to distil "cedar-leaf oil." Early French colonists called this tree baton rouge, meaning red stick. It is said that Louisiana's capital took its name from this tree (53).



Eastern redcedar grows throughout the eastern half of the United States and in southern Ontario and the southern tip of Quebec (above). It is the most widely distributed coniferous tree in eastern United States, found in every State east of the 100th meridian except Florida (17, 23, 27, 31).

HABITAT CONDITIONS

Climate

The wide range of eastern redcedar clearly indicates its ability to grow under various climatic conditions. Throughout this range the average annual precipitation varies from 16 inches in the west to 60 inches in some parts of the south (51). In some sections precipitation is heaviest during the summer and in other sections it is fairly well distributed throughout the year. Average temperatures vary greatly, and the average length of growing season ranges from 120 to 250 days (51).

Because it can withstand the rigors of drought and storm and of heat and cold, eastern redcedar ranks high in survival among the conifers in the Great Plains shelterbelt plantings (4, 38, 48). In the northwestern part of its range, this species was only lightly injured by the severe winter conditions of 1947-1948 (50).

Soil

The species grows on a variety of soils ranging from dry rock outcrops to swampy land. It is frequently found on thin soils with limestone and dolomite outcrops, or other dry, rocky sites (3, 12, 23, 33, 54). However, it grows and develops best on deep, moist, well-drained soils (8, 22, 27). On these better soils, hardwoods are serious competitors and oftentimes the eastern redcedar is crowded out (7). In the Ozark region, natural stands occur on sites that range from deep alluvial soil to very shallow upland soil (8). Depth of soil and drainage greatly influence growth (1, 8). The following site-index classification, based on total height at 50 years, has been developed for the Ozark region (8):

Site	Soil depth	Site index
I	Alluvial soils, deep and well-drained	55-60
II	Upland soils, 24 inches and over in depth	45-50
III	Upland soils, 12-24 inches in depth	35-40
IV	Upland soils, 12 inches or less in depth	25-30

Eastern redcedar grows naturally in soils having pH values ranging from 4.7 to 7.8 (7). Although it will grow on sites that are slightly alkaline, it is not especially alkali tolerant. In fact, in comparative tests of alkali tolerance of drought-hardy trees and shrubs, eastern redcedar was rated in the least tolerant class (49). The fact that the soils under many redcedar stands are near neutral or slightly alkaline is probably because the trees themselves tend to make the soil beneath them more alkaline (7, 8, 13, 14, 15, 47).

Physiography

Eastern redcedar is found in all kinds of locations--on ridgetops, slopes, and flat land. It frequently occurs on dry, exposed sites and on abandoned fields (8, 9, 12, 32, 39). In the western part of its range, the species is found on the north-facing slopes and along stream banks where there is some protection from the heat and drought (3). In the hills and mountains of Arkansas, Missouri, Kentucky, and Tennessee, eastern redcedar frequently occurs in rocky limestone and dolomite areas (12, 16, 53). Almost pure stands are found on the relatively flat "Cedar Glades" area of the Nashville Basin in central Tennessee (12).

Associated Species

Pure stands of eastern redcedar are found scattered throughout the general range of the species. These are generally found on abandoned farmlands or on dry uplands. In addition to pure stands, the Society of American Foresters recognizes three additional types of which redcedar is a major component (46). The eastern redcedar-pine type, with redcedar and either shortleaf pine (Pinus echinata Mill.) or Virginia pine (Pinus virginiana Mill.) predominant, occurs throughout the southern half of the redcedar's range. In the eastern redcedar-hardwood type, cedar is found in mixture with several hardwoods including red and white oaks (Quercus spp.), hickories (Carya spp.), and black walnut (Juglans nigra L.) as the predominant hardwoods. This type occurs throughout the central part of the redcedar's range. The third type, eastern redcedar-pine-hardwood, contains a mixture of eastern redcedar, shortleaf and Virginia pines, and red and black oaks along with other hardwoods. All these forest types are temporary and are succeeded by various hardwood types. However, the replacement on the drier sites is very slow.

Eastern redcedar is also a minor component of three other types: post oak, black oak, gray birch-maple, and sassafras-persimmon (12, 27, 43, 46).

LIFE HISTORY

Seeding Habits

Flowering and fruiting.--In the spring small, inconspicuous male and female flowers appear on separate trees or occasionally on the same tree. The male flowers are yellow and form a short catkin. The female flowers are greenish with 3 to 8 pointed scales. Some or all of the scales may bear 1 or 2 ovules. The scales gradually become fleshy and in one season develop into a dark blue, highly aromatic, berrylike cone with 1 or 2, and rarely 3 or 4 small seeds (16, 27, 52).

Seed production and dissemination.--Good seed crops are produced every 2 or 3 years with light crops in the intervening years. The best seed-bearing age is between 25 and 75 years, although some trees will bear at 10 years and some as late as 175 years (52). A pound of freshly collected berries will yield from 7 to 10 thousand seeds. There are 17,600 to 59,000 seeds per pound which in commercial lots average about 70 percent sound (52).

Seed is dispersed almost entirely by birds and mammals (52). Small mammals and many species of birds including quail, grouse, pheasant, and turkey, feed on the fruit of eastern redcedar, especially in winter (7, 24, 27, 35, 40, 54).

Vegetative Reproduction

Eastern redcedar does not reproduce naturally by sprouting or suckering, but it can be propagated from cuttings and layering as well as by grafting (7, 52). Many of the ornamental forms are propagated vegetatively (27).

Seedling Development

Establishment.--Most of the natural germination of eastern redcedar seed occurs in the early spring the second year after dispersal (27, 52), although a few seeds may germinate the first and third years. Most of the delay in germination is caused by embryo dormancy and, possibly in some cases, by an impermeable seed coat (52). In nursery practice this dormancy is overcome by stratifying the seed in moist sand or peat and storing at a low temperature. Moreover, acid treatment or mechanical scarification are sometimes used before stratifying (2, 52). It has been reported that freezing the seed in ice for 21 days is a satisfactory treatment for breaking dormancy (30).

The best natural seedbed is moist, loamy, mineral soil that is somewhat calcareous (52). On the very dry sites most seedlings are found in protected places, such as crevices or between layers of limestone, where the microclimate is more favorable to germination (3). Tests indicate that about one-third of the seeds germinate (52).

Early growth.--Eastern redcedar seedlings are fairly drought-hardy partly because of a deep, penetrating tap root and the relatively small leaf surface (41). During the first year, seedlings do not produce much top growth, but they do develop a long, fibrous root system. Growth is markedly influenced by microclimate and soil conditions. Seedlings will often survive on dry sites, but growth is slow. Best growth occurs on rich, slightly calcareous soil where the pH value is not more than 7.8, and moisture conditions are favorable (22). The species is rather intolerant in the seedling stage. In the Southern Piedmont area, redcedar seedlings under open stands survive better than those under closed canopy stands (41). A controlled study indicated that the height growth of 1-0 seedlings in full sunlight and one-third sunlight were the same. But when grown in one-tenth sunlight, seedling growth was stunted (36).

Seedlings are highly resistant to organisms causing damping-off (52). In nurseries, seedlings are sometimes injured by a blight disease called Phomopsis juniperovora. Occasionally, mice and rabbits damage young trees.

Sapling Stage to Maturity

Growth and yield.--Eastern redcedar is a relatively slow grower and a long rotation is required to grow it to sawtimber size (45, 54, 55). Trees 20 to 30 years old are generally 18 to 24 feet tall and 2 1/4 to 3 inches in diameter (11). Ordinarily the mature tree is 40 to 50 feet tall with a short bole 12 to 24 inches in diameter. On good sites it may reach a height of 120 feet and diameter of 4 feet (16, 27). But, on dry sites in the prairie region, trees 110 years old are often less than 20 feet tall. The species is classed as medium-lived except in Canada where it is short-lived (45). The maximum age has been reported to be about 300 years (27).

Radial growth begins early in the spring and continues until late fall, and the growth rate is closely associated with moisture supply (28, 29). In Georgia, eastern redcedar had a longer growing period and slower growth rate than either pines or hardwoods (29). For most of the hardwoods, half the total radial growth was completed in about 50 days as compared with more than 100 days for eastern redcedar. In the Ozarks, the average annual diameter growth of dominant trees for a 10-year period varied according to site as follows (8):

Site Index (50 years)	Open Stands (Understocked)	Dense Stands (Well-stocked)	Closed Stands (Overstocked)
	inches	inches	inches
I (55-60 feet)	0.30	--	--
II (45-50 feet)	.32	0.32	0.15
III (35-40 feet)	.18	.17	.10
IV (25-30 feet)	.14	.12	.07

Some pure stands of eastern redcedar are overstocked and stagnated. Pure stands do not thin themselves naturally. In 1903 an acre of land in the Ozarks was planted with 1,225 eastern redcedar seedlings. Forty-four years later 1,027 of these trees still survived, and only 3 percent of them were overtopped (5). In managing redcedar it is important to regulate tree spacing so that the stands do not stagnate. Spacing is also an important factor when producing sawlogs free from defect. Stands should not be opened enough to encourage growth of the lower limbs, because the limbs are persistent. If pruning is done close to the trunk, the wound will not heal over, so if limbs must be removed a stub 8 to 10 inches long should be left (30).

Enemies

Fire is the worst enemy of eastern redcedar. The thin bark and roots near the surface of the ground are injured by relatively light surface fires (6, 11, 16, 53).

Few insects cause any serious damage to the trees. Occasionally, boring insects feed on living trees and bagworms eat the foliage. Ornamental and nursery-grown trees may be damaged by the juniper webworm and seed-corn maggot (53).

Wood rots do some damage to trees in the south. Fomes annosus is sometimes a serious pathogen that destroys the sapwood of the tree (18). Trees that are suppressed seem to be particularly susceptible to attack by this fungus (37). Two brown cubical rots caused by Fomes subroseus and Daedalea juniperina are sometimes found in the heartwood (18). These rots and their conks generally occur on the trunk well above the ground, whereas Fomes annosus conks almost always occur at the ground line or in the roots. Eastern redcedar is the bridging host for apple-cedar rust. The disease is very damaging to apples, but it does relatively little harm to the cedar (27, 53).

Reaction to competition.--Eastern redcedar has been classed as very intolerant in New York and New England, and intolerant in southeastern United States (45). On thin, dry soils the species is able to withstand competition of hardwoods, but on better sites hardwoods usually replace the redcedar (6, 22, 46). It is a pioneer species that invades old fields and pastures (3, 6, 9, 23, 32, 34). In southern New England and on the Piedmont of New Jersey, these redcedar stands on abandoned fields begin to deteriorate at about 60 years. By this time hardwoods are established and take over the stand (9, 32). On most sites eastern redcedar is probably temporary and usually replaced by hardwoods or pine-hardwood communities (46). On the glade sites in the Ozarks and Tennessee eastern redcedar is a more permanent type (10, 12, 22, 42). On these sites succeeding hardwood and pine vegetative types are extremely slow in taking over.

RACIAL VARIATION

There is a pronounced racial variation within the species (26). This is to be expected for eastern redcedar grows over a wide range and under varying conditions. Many ornamental forms have been discovered and propagated. Little is known as to the existence of climatic races. However, a northern form, Juniperus virginiana var. crebra, is recognized. It has a narrower crown and slightly pitted seeds (19). Undoubtedly, other geographic races exist, but they have not been identified.

No hybrids have been recognized, although there is some evidence of hybridization between Juniperus virginiana and other Juniperus species (20, 21, 25, 27, 44).

SPECIAL FEATURES

Eastern redcedar is held in high regard as a shelterbelt tree for planting in the Great Plains (11, 49). Also, it is extensively used for ornamental and wildlife plantings. The tree provides good winter cover and food for upland game birds (54).

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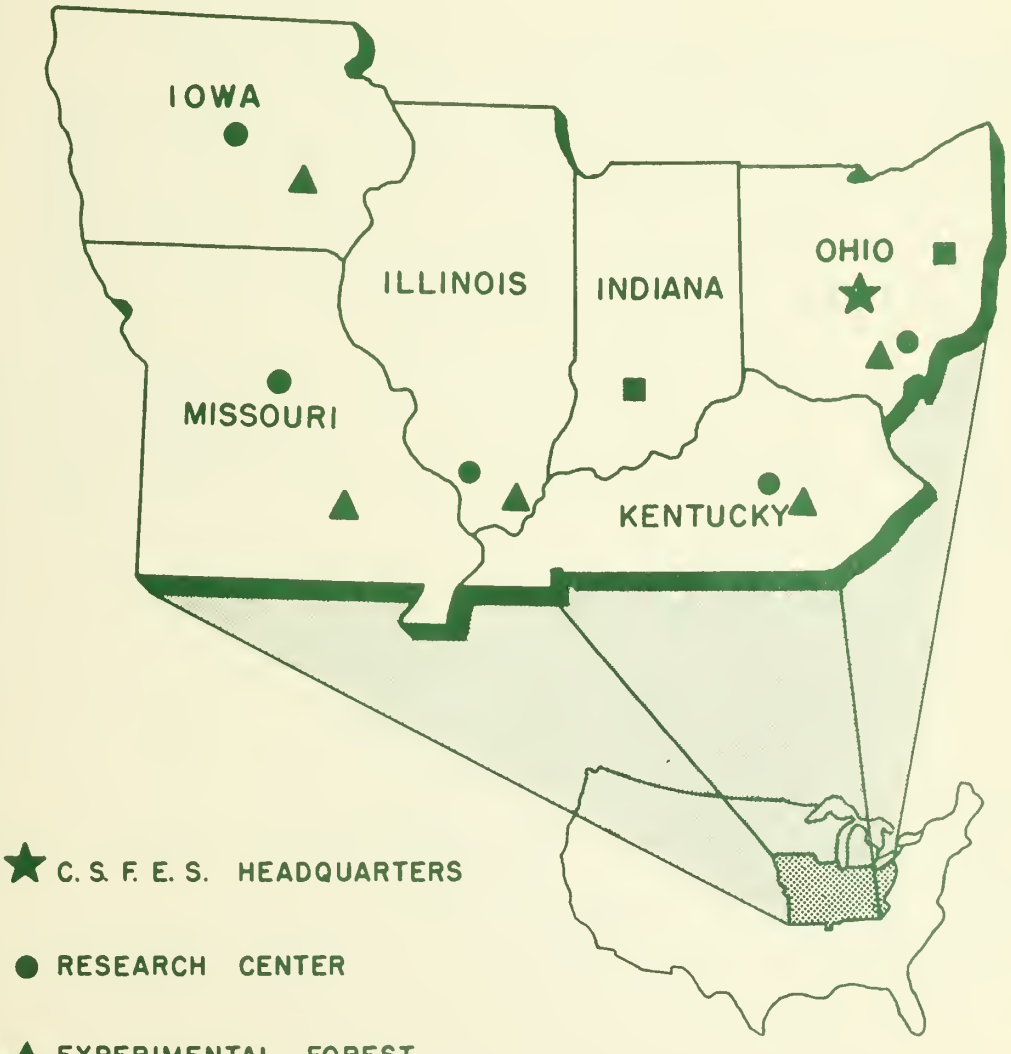
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